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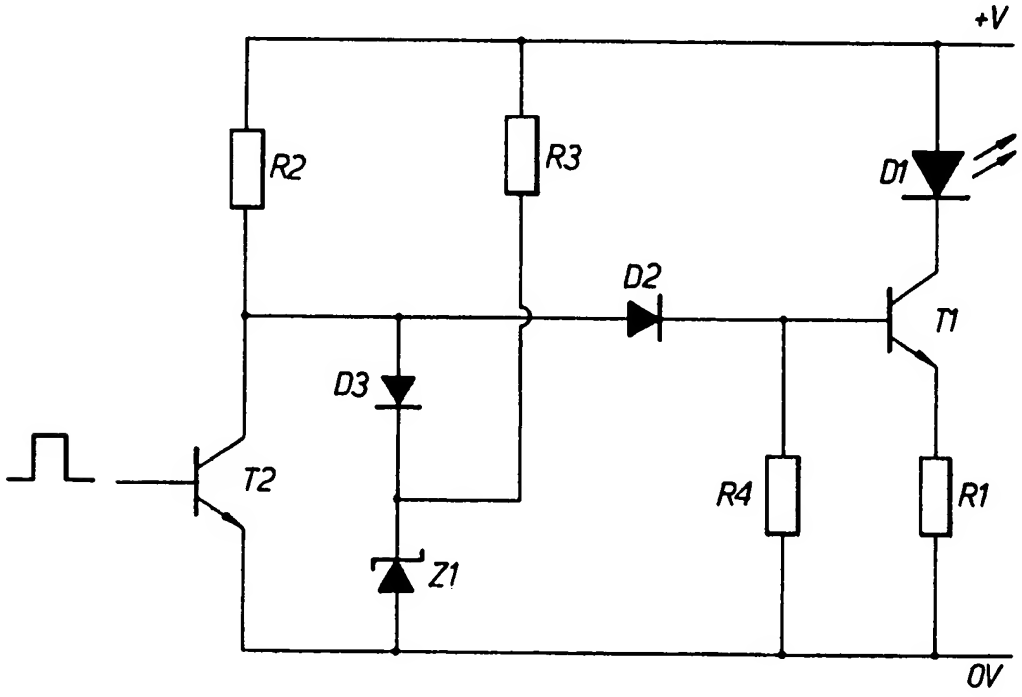
(54) LED modulator

(57) A modulation driver circuit for a light emitting diode (LED) D1 wherein the LED is connected in series with the emitter-collector circuit of a current switching transistor T1 across a source of defined current sufficient to energise the LED into a light emitting state when the current switching transistor is switched on, the base of the current switching transistor being coupled to a signal current binary input, characterised in that the voltage at the base of the current switching transistor is set by a Zener diode Z1 constantly biassed to provide a substantially constant voltage to the base of the transistor when the signal input assumes one binary condition, the Zener diode and the base of the current switching transistor each being connected to the signal input via respective gating diodes D3, D2 which are both reverse biassed to isolate the transistor and the Zener diode respectively from the signal input when the signal input assumes the other binary condition.



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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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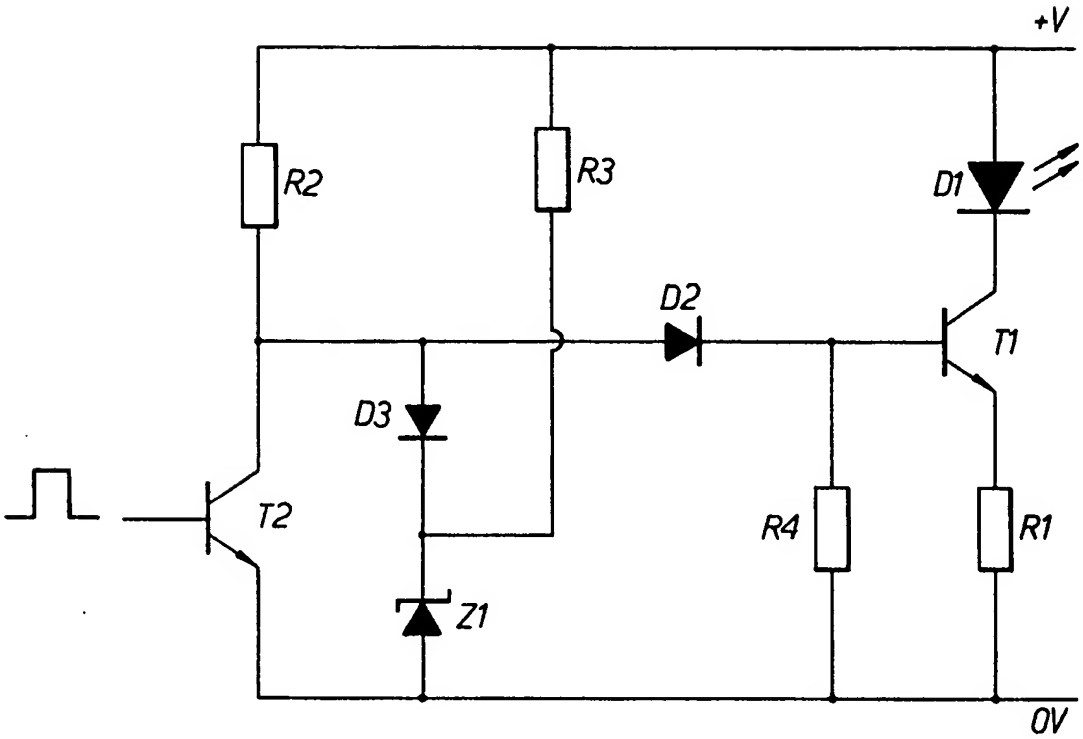

SPECIFICATION

LED modulator

This invention relates to a modulation driver circuit for a light emitting diode (LED) such as is used in optical transmission systems.

A previous driver circuit design uses up to five transistors in various stages, e.g. to standardise the incoming signal pulse height, to amplify the standardised pulse and then to provide an output stage to apply the actual driving current to the LED. This requires a considerable number of components and a suitably large printed circuit board area.

It is an object of the present invention to provide a simpler circuit for driving a LED in response to a binary input signal, with fewer components and a considerable reduction in board area.

According to the present invention there is provided a modulation driver circuit for a light emitting diode (LED) wherein the LED is connected in series with the emitter-collector circuit of a current switching transistor across a source of defined current sufficient to energise the LED into a light emitting state when the current switching transistor is switched on, the base of the current switching transistor being coupled to a signal current binary input, characterised in that the voltage at the base of the current switching transistor is set by a Zener diode constantly biassed to provide a substantially constant voltage to the base of the transistor when the signal input assumes one binary condition, the Zener diode and the base of the current switching transistor each being connected to the signal input via respective gating diodes which are both reverse biassed to isolate the transistor and the Zener diode respectively from the signal input when the signal input assumes the other binary condition.

An embodiment of the invention is now described with reference to the accompanying drawing depicting a circuit diagram of a LED driver circuit.

The light emitting diode D1 is connected in series with a current switching transistor T1 and resistance R1 across a current source +V to OV. Typically the value of +V is 5 volts, R1 is 11 ohms and D1 requires 150mA. The input signal current to the base of transistor T2 is typically less than 5mA. The base of T1 is connected to the collector of T2 via a gating diode D2. The collector of T2 is also connected via another gating diode D3 and a Zener diode Z1 to the OV rail, and via a resistor R2 to the 5V rail. The Zener diode Z1 is also connected via resistance R3 to the 5V rail. Finally, resistance R4 is connected between the base of T1 and the OV rail.

The input current source from the binary logic driver (not shown) applied to the base of T2 must be set high enough to allow saturation of T2 but not so high as to make the driver supply too much current. When the binary input goes 'high'' then transistor T2 saturates and the collector of T2 drops to a low voltage, thereby reverse biasing diode D3 and consequently turning T1 'off'. Zener diode Z1 stays 'on' however, biased by R3. When the input goes 'low', T2 is turned 'off' and resistance R2 pulls the D2, D3 junction up to about 3.1v, making the base of T1 about 2.45V. The voltage drops across D2 and D3 cancel approximately, so that the voltage on the base of T1 is determined by the reference Zener diode Z1. T1 is thus turned 'on' and allows the LED D1 to draw current through resistance R1. This current is set by the value of R1 to be 150mA and is now independent of the original drive voltage, depending as it does solely on Z1 and R1. It should be noted that the current supplied by R2 must be large enough to supply sufficient base current to T1. Resistance R3 supplies a constant bias to Z1 to prevent Z1 from switching at the bit rate of the input signal. Resistance R4 provides a path for the charge stored in the base of T1 to be discharged.

As a modification of the circuit illustrated, if the driving logic can sink the current in R2 it is possible to dispense with T2. The driving logic can then be connected direct to the junction of R2, D2 and D3.

The circuit of this invention has the advantage that because of the gating action of the diodes D2 and D3 around Z1 the Zener diode can remain biased at all times. Also, the output current into the light emitting diode D1 is substantially independent of the drive pulse amplitude.

CLAIMS

1. A modulation driver circuit for a light emitting diode (LED) wherein the LED is connected in series with the emitter-collector circuit of a current switching transistor across a source of defined current sufficient to energise the LED into a light emitting state when the current switching transistor is switched on, the base of the current switching transistor being coupled to a signal current binary input, characterised in that the voltage at the base of the current switching transistor is set by a Zener diode constantly biassed to provide a substantially constant voltage to the base of the transistor when the signal input assumes one binary condition, the Zener diode and the base of the current switching transistor each being connected to the signal input via respective gating diodes which are both reverse biassed to isolate the transistor and the Zener diode respectively from the signal input when the signal input assumes the other binary condition.

2. A circuit according to claim 1 characterised in that the signal input is applied to the base of a second transistor the emitter-

collector circuit of which is connected in series with a resistor to form a voltage divider connected across the current source, the resistor-transistor connection point being connected via the gating diodes to the current switching transistor and the Zener diode.

3. A modulator driver circuit for a light emitting diode substantially as described with reference to the accompanying drawing.

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